HEALTH CONSULTATION

Determination if Site Specific Interior Dust Clean-up Levels
Are Protective of Public Health

HERCULANEUM LEAD SMELTER SITE

HERCULANEUM, JEFFERSON COUNTY, MISSOURI

EPA FACILITY ID: MOD006266373

January 15, 2004

Prepared by:

Missouri Department of Health and Senior Services
Division of Environmental Health and Communicable Disease Prevention
Section for Environmental Public Health
under cooperative agreement with the
Agency for Toxic Substances and Disease Registry

STATEMENT OF ISSUES AND BACKGROUND

Statement of Issues

The Missouri Department of Health and Senior Services (DHSS) and the Agency for Toxic Substances and Disease Registry (ATSDR), were asked by the U.S. Environmental Protection Agency (EPA) to participate in a Herculaneum Lead Smelter Site workgroup. The workgroup consisted of two consultants (Dr. Scott Clark, Ph.D., PE, CIH and Dr. David Sterling, Ph.D., CIH), community members, representatives from the Missouri Department of Natural Resources (MDNR), ATSDR, DHSS and EPA. The workgroup was tasked with evaluating interior lead dust clean-up levels for Herculaneum. The workgroup submitted a final report, entitled the "Technical Report for Focus Group Recommendations, Herculaneum, MO" to the Community Action Group on October 6, 2003. Site-specific recommendations for establishing lead dust sampling protocols, setting clearance standards, determining if additional clean-up actions are necessary and developing a model work plan were included in the report.

EPA asked that DHSS, in cooperation with ATSDR, review the submitted report to determine if the site-specific interior lead dust clean-up levels that have been recommended by the work group, are protective of public health. This Health Consultation will review the recommendations of their report and make a determination if the clean-up levels are protective of public health.

Background

The Herculaneum lead smelter is an active facility that has been in operation in this community since 1892. The Doe Run Company currently owns and operates the smelter. The facility is located at 881 Main Street in Herculaneum, Missouri, approximately 25 miles south of St. Louis, Missouri, on the Mississippi River. The smelter abuts residential neighborhoods on the north, west, and south, with the Mississippi River on the east. A lead ore concentrate, consisting of approximately 80% lead sulfide, is processed at the smelter. The ore is transported by truck from eight lead mines operated by the company near Viburnum, Missouri, approximately 75 miles south-southwest of Herculaneum. The 52-acre Herculaneum facility consists of a smelter plant, 24-acre waste slag storage pile, and an onsite sulfuric acid plant (1).

The city of Herculaneum has an estimated population of 2,805 people, according to the 2000 US Census. Several homes are within 200 feet of the smelter plant, and currently at least three homes are within 200 feet of the slag pile, one of which is occupied. Figures 1 and 2 display the location of the smelter in relationship to the community (2). Three schools are in the city: a high school, a middle school and a junior high school. The elementary school is approximately two

miles away in Pevely, MO. There are no licensed day-care facilities in the city of Herculaneum.

Environmental sampling has indicated that there is lead contamination throughout the community. For example, lead has been found in yard soils at concentrations up to 33,100 parts per million (ppm) (3) and in ambient air ranging from non-detectable (ND) to 85 micrograms per cubic meter ($\mu g/m^3$) (4). Lead concentrations on streets have been as high as 300,000 ppm (5), with loading levels up to 8.72 milligrams per square foot or mg/ft^2 (6). Although multiple sources of lead could be contributing to the overall contamination, an Exposure Investigation (EI) conducted by ATSDR in 2001 indicated that lead in paint and water at the two homes evaluated did not appear to be significant sources of lead exposure in the children who lived in these homes and had elevated blood lead concentrations (7).

Efforts to address the overall lead contamination in the community have intensified since September 2001, when the MDNR and the EPA confirmed that spillage of lead concentrate was occurring along transportation routes in the city (8). This information prompted DHSS to alert MDNR that the risks to the public surrounding the site were clear and present and that they were an imminent and substantial endangerment to the health of residents of Herculaneum (8). Subsequently, MDNR and EPA directed the Doe Run Company to expedite activities to clean-up existing contamination and reduce/eliminate future contamination throughout Herculaneum. The Doe Run Company, with oversight from MDNR and EPA, has implemented several exposure reduction activities since that time including addressing street lead contamination, controlling fugitive dust and smelter air emissions, soil removal/replacement and cleaning the interior of homes with elevated lead dust levels (8).

Despite the actions taken to address existing lead contamination in Herculaneum, active sources of contamination remain. The smelter is currently operational, and is expected to remain operational for the foreseeable future. Although many controls have been added to reduce fugitive dusts and stack emissions from the smelter, the smelter is still permitted to emit up to 858.8 pounds lbs of lead per day (9). Lead concentrate is trucked in for processing on a daily basis. Improvements have been made in the hauling procedures; however, small concentrate spills still occur, and concentrate is tracked out of the facility by the haul trucks. These factors together continually contribute to elevated soil lead levels. Elevated soil lead levels increase the lead loading levels at the exterior entry of homes, which in turn increases the interior lead dust levels in Herculaneum. A speciation study of samples collected from Herculaneum streets, soil and houses concluded that 30% of household dust comes from exterior soil and 50% is from road dust (6).

Many of the homes in Herculaneum have lead dust levels that pose a potential health threat to the residents living in them. As a result, in October of 2002, EPA asked Drs. Clark and Sterling, with input from the workgroup members, to evaluate current clean-up levels, establish lead dust sampling protocols, set acceptable clearance standards, determine if additional clean-up actions are necessary and develop a model work plan.

In addition to recommending a lead dust clean-up level, the report discusses clean-up strategies and monitoring plans to ensure that these actions will effectively reduce exposures to an acceptable level (6). For interior clean-ups, the report recommends following the protocol in the HUD Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing (10). The report recommends collecting interior samples before and after cleanup and on a quarterly basis thereafter to verify the effectiveness of the clean-up. The need for soil removal and replacement, long term interior and exterior monitoring, and continued health communication and education were reiterated in the report. The report also suggests the formation of an Oversight Board for continuing evaluation of the clean-up process and the establishment of a trust fund to help fund the clean-up of attics and walls as houses are renovated.

Discussion

In considering an appropriate and protective dust lead clean-up level for this site, Drs. Clark and Sterling and the EPA work group members reviewed the available Herculaneum environmental data and studies. They concluded that there was not enough existing data (blood lead screening data and the corresponding environmental data) to determine a dust lead clean-up level using only site-specific data (6). Thus, the available Herculaneum information was combined with studies conducted at other lead sites to form the basis for the Herculaneum Interior Dust Technical Report and Work Plan. Data from sites other than Herculaneum were considered for this report because they have similar contaminants and exposure pathways. The Technical Report is attached as appendix A and is referenced in this Health Consultation.

In developing a recommendation for a site-specific interior dust lead clean-up level for Herculaneum, scientific evidence was evaluated which indicates that the current EPA lead dust standard, 40 $\mu g/ft^2$ for floors, may not be protective of public health at this site. The EPA standard was designed primarily for houses where lead-based paint is the primary lead source (6). However, lead paint is not the only source of lead exposure in Herculaneum. For over 100 years, the smelter has released lead in their stack emissions as well as in fugitive dust from activities throughout the smelter, which has built-up in soil and other media over time. Although lead emissions from the smelter are declining, the smelter is still allowed to release up to 858.8 pounds of lead per day into the atmosphere (9). This continuing deposition and the historical environmental burden that has accumulated must be taken into account in the development of any interior lead dust clean-up level (6).

Additional evidence supporting the need for a site-specific interior lead dust clean-up level lower than 40 $\mu g/ft^2$ can be found at the Big River Mining Site, a nearby lead mining area of Missouri (6). The Big River Mining Site is similar to Herculaneum in that elevated lead concentrations were present in several site media and people were being exposed to that lead through several exposure pathways. Because of the multiple exposure pathways present at the site, a site-specific floor clean-up level of 24 $\mu g/ft^2$ was proposed and determined to be protective of public health at the Big River Mining Site (11).

Another factor that must be considered in determining clean-up levels for lead is the relative bioavailability. Relative bioavailability is a measure of how readily lead, or any other chemical, is taken up by the body. In general, the relative bioavailability of lead is approximately 30%. A study was conducted to determine the relative bioavailability of lead from Herculaneum. The study concluded that the site-specific relative bioavailability of lead from Herculaneum was approximately 36%, which is higher than average (12).

Drs. Clarke and Sterling's review of these scientific studies and other lead site data analysis, were used as the scientific basis to propose an interior lead dust clean-up level of 20 $\mu g/ft^2$ for Herculaneum residences (6).

Currently, one-half of the houses in Herculaneum that have had interior clean-ups completed have average floor dust lead levels of less than 20 $\mu g/ft^2$ (6). With additional interior house dust lead removal, lead-based paint stabilization and ongoing street cleaning to remove lead, an interior lead dust clean-up level of 20 $\mu g/ft^2$ appears to be attainable (6).

Additional strategies to ensure that the actions taken at Herculaneum are effective and will effectively reduce exposures to an acceptable level were discussed in the report (6). For interior clean-ups, the report recommends following the protocol in the HUD Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing (10). These are standard procedures used in interior lead abatements. The report recommends collecting interior samples before and after cleanup to verify the effectiveness of the cleanup. Quarterly sampling of home interiors is recommended in the report to ensure that there is minimal recontamination occurring and to ensure the long-term effectiveness of the cleanup. The need for soil removal and replacement, long term interior and exterior monitoring, and continued health communication and education were reiterated in the report. These activities are ongoing, and are expected to continue.

Child Health Initiative

Children and adults are exposed to lead in many of the same ways. However, children are not small adults. They differ in the behaviors that lead to their exposures as well as their susceptibility to toxic effects from lead exposures. Children are more likely to play outdoors and bring food into contaminated areas. They are also shorter than adults, so are more likely to breathe dust and soil that are close to the ground. Children are smaller, resulting in higher doses of chemical exposure per pound of body weight.

Further, children have rapidly developing body systems that can sustain permanent damage if toxic exposures occur during critical growth stages. Compared to adults, children absorb more of the lead they take into their bodies, retain more of the lead they take in, and are more sensitive to

its effects.

Children in this community are being exposed to lead inside their homes as well as outside in their yards, playgrounds, parks, and while attending school. This community is faced with continuing widespread environmental contamination that is very different from other communities. Therefore, because children depend on adults for risk identification and management decisions, it is prudent that further lead exposure be prevented by such efforts as lowering the interior lead dust clean-up level for this community and controlling other sources of lead in this community.

Conclusion

DHSS and ATSDR concur with the site-specific dust lead clean-up level (20 $\mu g/ft^2$) in the context of related activities (use of the HUD Guidelines, pre- and post-cleanup sampling, long-term quarterly sampling, continued soil replacements, health communication and education) proposed in the "Technical Report for Focus Group Recommendations, Herculaneum, MO."

The lead smelter in Herculaneum has operated for over 100 years, and will continue to operate and be a source of lead in the community for the foreseeable future. Several environmental media have elevated lead concentrations (soil, air, interior dust, road dust). Additionally, the lead present in Herculaneum has a relative bioavailability which is higher than average. These factors combined indicate that a site-specific interior lead dust clearance level lower than 40 $\mu g/ft^2$ is appropriate to create a margin of safety for the residents of Herculaneum. Based on the available information about the site and the information reviewed in this report, an interior lead dust clearance level of 20 $\mu g/ft^2$ offers that margin of safety.

The prudent public health actions outlined in the clean-up protocol and monitoring recommendations in the report are the logical steps necessary to ensure continuation of a safer environment for the residents of Herculaneum, Missouri.

Recommendations

1. EPA and MDNR should provide oversight to assure that procedures are implemented to attain and maintain the interior lead dust clearance levels in residences in Herculaneum as outlined in the Herculaneum Technical Report and Work Plan. In particular, the regulatory agencies should ensure that the HUD guidelines are followed for indoor clean-ups, that pre- and post-clean-up and longer-term quarterly samples are collected and analyzed to ensure effectiveness of the cleanup and that remedial efforts to decrease lead concentrations in other media should continue.

When additional information becomes available, DHSS will evaluate it thoroughly and, if

appropriate, update existing assessment documents. ATSDR and DHSS will respond appropriately to any request for additional information or action.

PUBLIC HEALTH ACTION PLAN

The Public Health Action Plan (PHAP) for the Herculaneum Lead Smelter site contains a description of actions to be taken by the DHSS, ATSDR, and others. The purpose of the PHAP is to ensure that this health consultation not only identifies public health hazards, but also provides an action plan to mitigate and prevent adverse human health effects resulting from present and/or future exposure to hazardous substances at or near the site. Implicit in this plan is a commitment from DHSS and/or ATSDR to follow-up on this plan to ensure that it is implemented. The public health actions to be implemented by DHSS, ATSDR and /or cooperators are as follows:

1. DHSS/ATSDR will continue to evaluate any additional data that become available regarding human exposure or contaminants at the site, including identifying additional exposure pathways and evaluating health impacts of risk reduction and remediation plans.

2. DHSS/ATSDR developed and are implementing a comprehensive health education plan in this community. Those efforts will continue and will focus on increased childhood lead testing, awareness of lead poisoning, its adverse health effects, how to reduce exposures, especially for children, as well as residential interior lead dust clean-up and soil replacement.

3. DHSS and the Jefferson County Health Department (JCHD) should continue health education activities for both the people in the community and area health care providers. These activities should focus on awareness of lead poisoning, its adverse health effects, how to reduce exposures, and encourage blood lead testing, especially for children.

3. JCHD/DHSS/ATSDR will continue to assure case management of children with elevated BLLs.

4. DHSS/ATSDR are in the preliminary stages of initiating health study activities in this community.

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Attachments:

Figure 1- Site Map
Figure 2- Aerial Map
Appendix A – Technical Report for Focus Group Recommendations, Herculaneum, MO

Certification

This health consultation for the Herculaneum Lead Smelter Site was prepared by the Missouri Department of Health and Senior Services under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with the approved methodology and procedures at the time the health consultation was initiated.

Technical Project Officer, SPS, SSAB, DAC

The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation and concurs with its findings.

Section Chief, SPS, DHAC, ATSDR

REFERENCES

1. Missouri Department of Natural Resources, Division of Environmental Quality, Hazardous Waste Program. Preliminary Assessment: Herculaneum Lead Smelter Site, Jefferson County, Missouri. March 30, 1999.

2. Agency for Toxic Substances and Disease Registry. Health Consultation for Herculaneum Lead Smelter Site: Atlanta: US Department of Health and Human Services; 2001 Jul 13.

3. Environmental Protection Agency. Transmittal from Bruce Morrison to Missouri Department of Health and Senior Services, January 8, 2002.

4. Missouri Department of Natural Resources. Transmittal from David Mosby to Tony Petruska, Environmental Protection Agency, Sample#A58, November 28, 2001.

5. Walker P. Missouri Department of Health and Senior Services. Herculaneum, Missouri Lead Contamination Health Threat. September 13, 2001.

6. Clark, C. S. and Sterling, D. A. Technical Report for Focus Group Recommendations, Herculaneum, MO. October 6, 2003 Attached

7. Agency for Toxic Substances and Disease Registry. Health Consultation on Exposure Investigation on Herculaneum Lead Smelter Site, Herculaneum, Missouri. Atlanta: US Department of Health and Human Services; 2001 September 14.

8. Agency for Toxic Substances and Disease Registry. Health Consultation on Determination if Remedial Actions are Protective of Public Health, Herculaneum Lead Smelter Site, Herculaneum, Missouri. Atlanta: US Department of Health and Human Services, 2002 April 16.

9. Missouri Department of Natural Resources. Restriction of Emissions of Lead from Primary Smelter-Refinery Installations. 10 CSR 10.6.120.

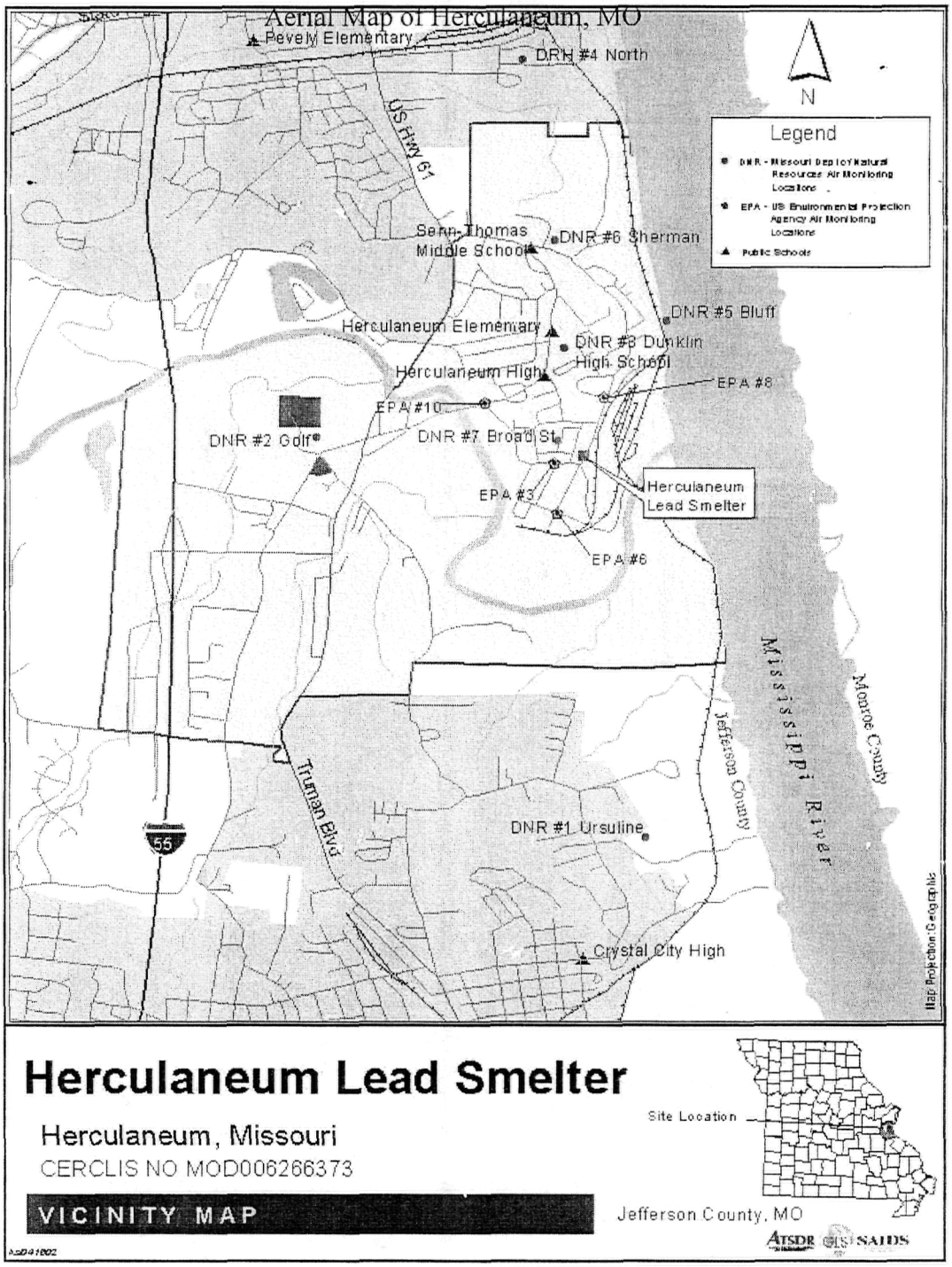
10. Housing and Urban Development. Guidelines for the Evaluation and Control of Lead-based Paint Hazards in Housing. Washington, DC: U.S. Department of Housing and Urban Development, 1995.

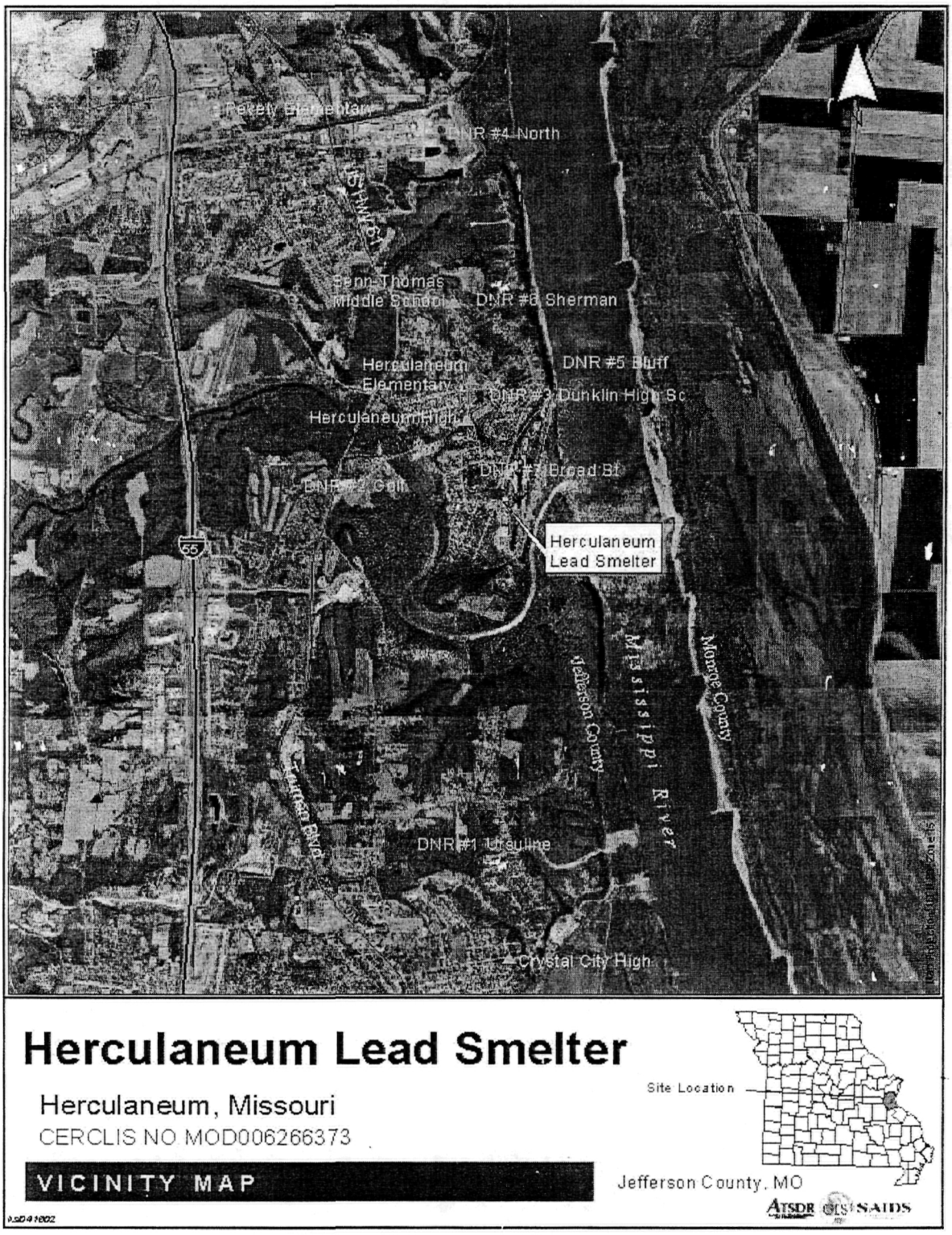
11. Sterling, D. A., Roegner, K. C., Lewis, R. D., Luke, D. A., Wilder, L. C. and Burchette, S. M. 1999. Evaluation of Four Sampling Methods for Determining Exposure of Children to Lead-Contaminated Household Dust, *Environmental Research*, 81(A): 130-141.

12. Casteel, Stan W., Evans, Tim E., Bratton, William J. and Hammon, Tracy L. Bioavailability of Lead In Test Materials. Doe Run Experiment 1. Draft. June 2001.

Figure 1

Figure 2





Herculaneum Lead Smelter

Herculaneum, Missouri

CERCLIS NO MOD006266373

VICINITY MAP

Jefferson County, MO

ATSDR GIS/SAIDS

Appendix A

Technical Report for Focus Group Recommendations
Herculaneum, MO

Exposure and Demographic Structure File

Site Name Herculaneum Lead Smelter Site

CERCLIS Number EPA Facility ID MOD006266373

Cost Recovery Number: 70PY

The purpose of this data collection instrument is to enhance the entry of the data into HazDat for use in the various reports required under the Government Performance & Results Act and the National Performance Review process. The data captured on this form is required for inclusion within the text of public health assessments.

THIS IS A TECHNICAL ASSISTANCE DOCUMENT WITHOUT DISCUSSION OF EXPOSED POPULATIONS

MANDATORY: The Public Health Hazard Category for **CURRENT** site conditions is:

- ❑ Urgent Public Health Hazard .....because of .....
- ❑ Public Health Hazard
  - ❑ Completed Exposure Pathways
  - ❑ Physical Hazard Pathways
  - ❑ Potential Exposure Pathways
- ❑ Indeterminant Public Health Hazard
  - ❑ Inadequate Information
- No Apparent Public Health Hazard
- ❑ No Public Health Hazard
  - ❑ No Completed Exposure Pathways
  - ❑ Other

OPTIONAL: The Public Health Hazard Category for **PAST** site conditions is:

- ❑ Urgent Public Health Hazard .....because of .....
- ❑ Public Health Hazard
  - ❑ Completed Exposure Pathways
  - ❑ Physical Hazard Pathways
  - ❑ Potential Exposure Pathway
- ❑ Indeterminant Public Health Hazard
  - ❑Inadequate Information
- ❑ No Apparent Public Health Hazard
- ❑ No Public Health Hazard
  - ❑ No Completed Exposure Pathways
  - ❑ Other

OPTIONAL: The Public Health Hazard Category for **FUTURE** site conditions is:

- ❑ Urgent Public Health Hazard .....because of .....
- ❑ Public Health Hazard
  - ❑ Completed Exposure Pathways
  - ❑ Physical Hazard Pathways
  - ❑ Potential Exposure Pathways
- ❑ Indeterminant Public Health Hazard
  - ❑Inadequate Information
- ❑ No Apparent Public Health Hazard
- ❑ No Public Health Hazard
  - ❑ No Completed Exposure Pathways
  - ❑ Other

)ocument Name: Determination if Site Specific Interior
)ust Clean-up LevelsAre Protective of Public Health
)ATE: January 14, 2004

CERCLIS #: EPA Facility ID MOD006266373

'OTAL POPULATION ESTIMATES TABLE

Pathway Types	Estimated Total Population in Exposed or Potentially Exposed Pathways*	Minimum Population*	Maximum Population*
Potential Pathways On-site			
Potential Pathways Off-site			
Total Potential On and Off-site			
Completed Pathways On-site			
Completed Pathways Off-site			
Total Completed On and Off-site			
Potential and Completed Pathways On-site			
Potential and Completed Pathways Off-site			
Total Potential and Completed On and Off-site			
* The use of Greater than (>) or Less than (<) is not allowed.			

he estimated total population field is required. If you do not have an estimate, please compute the estimate using the mean of the minimum and maximum numbers. The mean is the sum f the values divided by the number of values. For this it would be: mean = (minimum + maximum)/2.

THIS IS A TECHNICAL ASSISTANCE DOCUMENT WITHOUT DISCUSSION OF EXPOSED POPULATIONS

Suggested Ranges for Minimum and Maximum Population Estimates:
. - 50
51 - 500
501 - 2500
2501 - 5000
5001 - 10,000
10,001 - 50,000
50,001 - 100,000
100,001 - 250,000